Ref 3392

FOSSIL INSECT ASSEMBLAGES FROM THE EMPIRE CINEMA SITE, BEDFORD

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Samples of Saxo-Norman and Early Medieval age from the Empire Cinema site, Bedford were submitted to the Ancient Monuments Laboratory for environmental analyses. Waterlogged pit infills from context 96 and 116 (pit No 50), 100 (pit No 69), 154 (pit 119) and layers 123 and 124 from a ditch yielded insects and plant remains which are detailed by Miss P Paradine elsewhere in this report.

The organic silts were initially treated by the paraffin flolation technique (Coope and Osborne 1968, Kenward 1980): the samples were disaggregated in warm, running water, washed on to a 300 micron sieve, drained, mixed with paraffin then cold water was added causing the lightest organic remains, including insect cuticle, to float. This flotant was decanted and sorted for arthropod sclerites. Subsequent sorting for seeds by Miss Paradine was carried out on this flotant and the entire residue, an essential process as paraffin flotation is not a satisfactory technique for concentrating seeds. Insect remains were present in all samples, although their preservation varied and sample 123 produced a degraded, fragmentary fauna. Seeds, which generally appear to be more resistant, showed less variation in their state of preservation between samples. The insect remains, dominated by beetles and occasional high totals of fly puparia, are composed of unaltered cuticle but another arthropod class, millipedes, have also been preserved at the site by the partial replacement of their more permeable exoskeletons by $CaCO_3$. This mechanism has been shown to be common in many sites with lime rich bedrock and/or hardwater drainage (Girling 1979).

Environmental implications of the insect faunas

The interpretation of the environmental conditions under which the organic silts were deposited is based upon assessment of the ecological requirements of the total

fauna, and their division into habitat groups. Problems of interpreting archaeological insect faunas, especially those from urban contexts, have recently been discussed by Kenward (1976, 1978). A major difficulty lies in defining ecological groups among those species which display a wide range of habitat requirements and differing degrees of specificity for particular living conditions. In the latter instance, stenotopic beetles, ie those with narrow habitat ranges, are more valuable as indicator fossils than eurytopes which tolerate a variety of conditions. The Bedford samples have been evalued on species content and then a method of faunal grouping has been applied to enable direct comparisons to be made between layers. The four groups are:

I Vegetation rubbish/dung/house-pest complex

II Aquatics

III Phytophages

IV Eurytopics

The rubbish complex includes taxa such as Cercyon spp which occur in a variety of damp vegetation habitats including pond edges, but whose habitat requirements are suited to accummulations of rotting plant material and/or dung where they are commonly found. Numbers of Staphylinidae also fall into this damp vegetation/ dung group. The rubbish complex has been extended to include the woodworm beetle, Anobium punctatum as it is a notorious pest of worked timber (Hickin 1968) and in a settlement site building timbers, fencing and dried logs for firewood provide major sources of infestation. Individuals in the rubbish complex might have arisen from flooring within timber constructed buildings, the disposal of worm-eaten wood or an infestation at source in wood in the pits. In contrast to this rubbish complex, the aquatic group is more strictly defined to include only those species which breed in ponds or streams and which require standing water as opposed to just damp mud or vegetation. The small weevil Tanysphyrus lemnae is also assigned to this category as it lives exclusively on the duckweed

Lemna, swimming between the plants which form a dense mat at the surface of the water, and whose presence indicates at least seasonal standing water in the ditch. Phytophages are plant feeders (excluding T lemnae) whose presence may be due to their inclusion in vegetation gathered for flooring or bedding, and the final eurytopic group is composed of beetles which occur in a wide range of habitats and those taxa where identification of incomplete fossil material could not be achieved to the level where habitat preferences could be established.

The faunas from the pits and ditches are generally dominated by the rubbish complex, but it is noticeable that there is more variation within the layers of the features than between the pits and ditches, reflecting changes in water level while they were in use.

Layers 116 and 96

Layer 116 represents the initial silting of a square-sided pit and it is overlain by layer 96 whose darker appearance, suggesting a higher organic content is borne out by the richer beetle fauna extracted from it. Several aquatic species are present in 116, amongst them Porhydrus lineatus which lives in silt-bottom or detritus pools in calcareous substrates, and the duck-weed feeder Tanysphyrus lemnae. The presence of water is further indicated by the ephippium, or egg case, of the water dwelling crustacean Daphnia. The wet conditions provide a suitable breeding place for Hydrobius fuscipes represented by four individuals and Ochthebius minimus. Records of Anobium punctatum reflect nearby availability of timber, and the ground beetle, Pterostichus melanarius is predominantly found on cleared ground, around buildings and in other synanthropic habitats. The faunal change in layer 96, strongly suggests that at this stage, the pit no longer contained standing water, and that vegetation refuse was accumulating probably as the result of dumping. Although part of the fauna must have originated with the transported refuse, for instance the pea or bean beetle

Bruchus rufimanus which lives on cultivated legume plants, conditions within the pit would have permitted breeding populations of numbers of the rubbish-complex beetles. The 60 fly puparia also suggest an in situ maggot population. Numbers of the beetles are associated with dung which is likely to have formed a constituent of the dumped rubbish; in addition to the dung beetles, Aphodius spp, there are records of Oxyomus sylvestris, Coprophilus striatus and Platystethus arenarius, species often found in dung. The dung and/or, rotting vegetation also provides suitable habitats for Cryptopleurum minutum, Sphaeridium sp., many Staphylinidae and Anthicus floralis. Helophorus rufipes, unlike most other species in its genus which occur mostly in aquatic or pond side habitats, is one of the turnip mud beetles, the others being H.nubilus and porculus. These species are recorded as breeding in turnips in the ground (Balfour-Browne 1958) and decaying plant materials. The distribution of the faunal groups from 116 and 96, shown in Fig I, illustrates the change from standing water to a damp accumulation of dung and/or vegetation refuse, although 116 is based upon a smaller fauna. When the aquatic fauna is plotted against totals of the rubbish complex fauna (Fig 2), a similar pattern emerges of drying out at the 96 level. The function of the pit can only be tentatively suggested by the insect data. Originally the water contained in the pit, perhaps fed by the gully, could have served as a well although it might equally represent accidental flooding of the hollow. The subsequent infill appears, however, to be a dump of house and stable sweepings, flooring and dung, and this implies use as a refuse pit.

Layer 100

This silty, organic basal layer of a square, straight sided pit yielded 91 beetles which fall dominantly into the rubbish complex faunal group. The commonest taxa are the dung and dung associated beetles: Aphodius and Cercyon spp. Dung

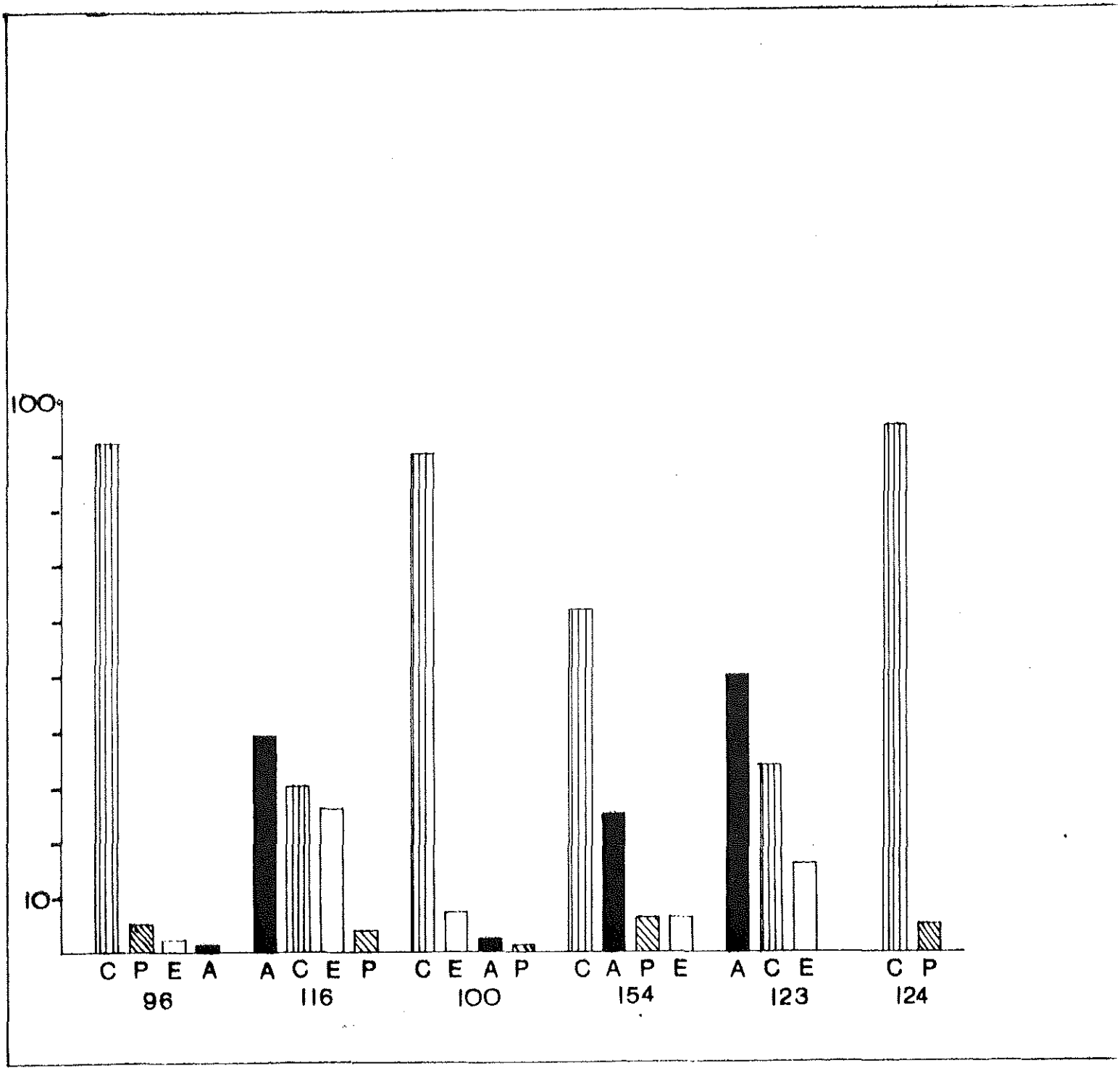


FIGURE I

Faunal groups in pit and ditch assemblages

A - Aquatic group

C - Compost group

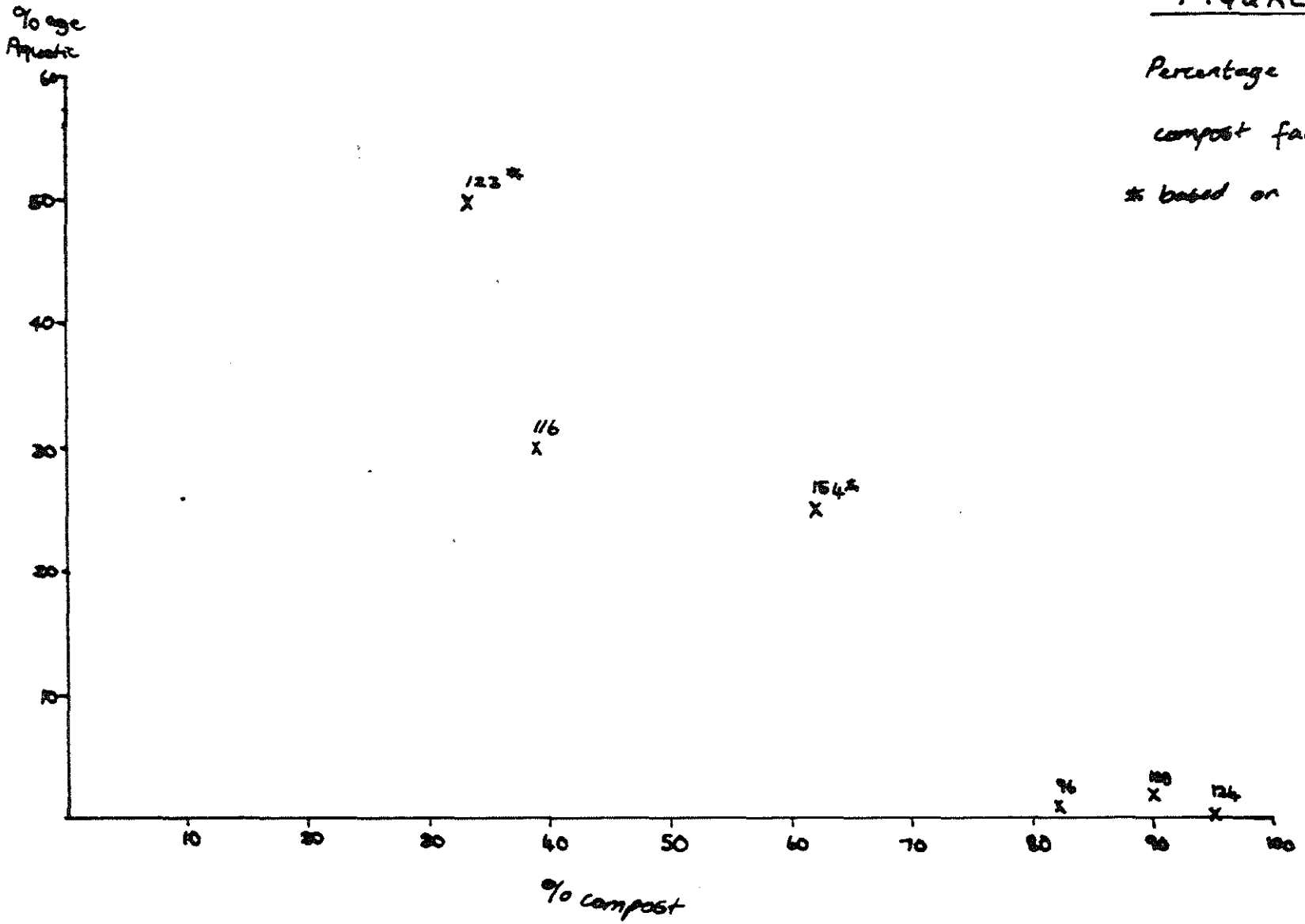
E - Eurytopic group

P - Phytophagous group

FIGURE 2

Percentage aquatic fauna against compost fauna

* based on low totals



and/or decaying vegetation are further suggested by O.sylvestris, Anotylus rugosus and H.nubilus. Species which lie outside the rubbish complex are H aquaticus and Dryops sp which live at pond edges. Although the former is a strong flier, these and the single caddis case might provide evidence for some water in the pit. In addition, the legume feeder Bruchus rufimanus is also present. This pit contained the $CaCO_3$ replaced millipede segments.

Layer 54

This layer represents the basal infill of a rounded pit cut into gravel. The poor preservation and paucity of insect remains from the silts might have resulted from the free drainage of the deposit. A small number of aquatic species recorded in the other pits are present, including H.aquaticus and O.minimus and there are larval caddis fly fragments. The rubbish complex is represented by Aphodius, Ceryon and Anotylus spp. and the small histerid Acritus nigricornis which occurs in general refuse. There is little in the fauna to suggest the possible function of the feature.

The pits generally appear to have acted as dumps for a settlement where farming including some animal husbandary. There is no direct evidence of a cess-pit function for the features, although the seeds reported by Miss Paradine do include fruits which may have formed part of the diet at the site.

Ditch Layers 123 and 124

The sequence suggested by the faunas from the two bottom layers of the ditch feature are of refuse accumulating in a water free feature which was subsequently flooded. True aquatic beetles are absent from the base of the pit, although water plant seeds are reported and may indicate flood refuse vegetation. The strongest indications are of the dung/rubbish group which includes the dor beetle Geotrupes, Falagria caesa and Onthophilus striatulus in addition to species present

in the pit deposits. Over 50 puparia were also recorded. Interpretation of the overlying layer is hindered by its very poor preservation, but occurrences of Colymbetes fuscus and Rhantus sp. suggest open water which is further indicated by caddis fly larvae and several small fish scales. The micro-environmental changes between these layers are illustrated in the faunal groupings of Fig I, and when the rubbish complex and aquatic totals are plotted, layer 124 is grouped with pit layers 96 and 100, suggestions that although the ditch may have had a drainage purpose at the site, it served for a time as a dump.

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BEDFORD, EMPIRE CINEMA

SPECIES LIST: ARTHROPODA	96	100	116	123	124	154	Total
ARTHROPODA							
DIPLOPODA							
Polydesmidae indet.	-	2	-	-	-	-	2
Fam., Gen. et sp. indet.	-	1	-	-	-	-	1
INSECTA							
DERMAPTERA							
Forficula auricularia (L.)	2	-	1	-	1	-	4
TRICHOPTERA							
Fam., Gen. et sp. indet.	-	1	-	2	-	1	4
HEMIPTERA							
Heteroptera indet.	-	-	3	-	1	-	4
COLEOPTERA							
Carabidae							
Nebria brevicollis (F.)	1	-	-	-	-	-	1
Clivina collaris (Herbst) or fossor (L.)	-	1	-	-	-	-	1
Pterostichus melanarius (Ill.)	-	-	1	-	-	-	1
Trechus obtusus Er. or quadristriatus (Schrank)	1	-	-	-	-	-	1
Dytiscidae							
Porhydrus lineatus (F.)	-	-	1	-	-	-	1
Rhantus sp.	-	-	-	1	-	-	1
Colymbetes fuscus (L.)	-	-	-	1	-	-	1
Hydrophilidae							
Helophorus aquaticus (L.)	-	-	-	-	-	2	2
H.brevipalpis Bed. (agg.)	-	5	3	-	-	-	8
H.grandis Ill.	-	1	-	-	-	-	1
H.nubilus F.	-	1	-	-	-	-	1
H.rufipes (Bosc)	2	-	-	-	-	-	2

Helophorus spp.	-	-	-	2	-	-	2
Sphaeridium sp.	4	-	-	-	-	-	4
Cercyon unipunctatus (L.)	1	-	-	-	1	-	2
Cercyon spp.	9	19	-	1	5	2	36
Cryptopleurum minutum (F.)	1	-	-	-	-	-	1
Hydrobius fuscipes (L.)	-	-	4	-	-	-	4
Histeridae							
Acritus nigricornis (Hoff.)	6	1	-	-	-	2	9
Onthophilus striatus (Forst.)	-	-	-	-	1	-	1
Hydraenidae							
Ochthebius minimus (F.)	1	-	1	-	-	1	3
Staphylinidae							
Lesteva longoelytrata (Goeze)	1	4	-	-	-	-	5
Omalium sp.	3	-	-	-	1	-	4
Coprophilus striatulus (F.)	1	-	-	-	1	-	2
Carpelimus or Thinobius spp.	7	-	-	-	-	-	7
Platystethus arenarius (Fourc.)	7	-	-	-	3	-	10
Platystethus sp.	-	-	1	1	-	-	2
Anotylus nitidulus (Grav.)	1	-	-	-	-	-	1
A.rugosus (F.)	2	1	-	-	1	-	4
Anotylus sp.	-	-	1	-	-	1	2
Stenus spp.	-	-	2	-	-	-	2
Lathrobium sp.	-	-	-	-	1	-	1
Xantholinus linearis (Ol.)	3	-	-	-	-	-	3
Philonthus sp.	1	1	-	-	-	-	2
Tachyporinae indet.	-	-	-	-	1	-	1
Falagria caesa Er.	-	-	-	-	1	-	1
Aleocharinae indet.	12	16	2	-	8	2	40
Geotrupidae							
Geotrupes sp.	-	-	-	-	1	-	1

Scarabaeidae							
Aphodius spp.	11	32	1	2	4	2	52
Oxyomus sylvestris (Scop.)	7	4	-	-	5	-	16
Dryopidae							
Dryops spp.	-	1	-	-	-	1	2
Anobiidae							
Anobium punctatum (Deg.)	2	2	3	-	1	1	9
Coccinellidae							
Coccidula rufa (Herbst)	-	-	-	-	-	1	1
Lathridiidae							
Lathridius sp.	-	-	1	-	-	-	1
Anthicidae							
Anthicus floralis (L.)	1	-	-	-	2	-	3
Bruchidae							
Bruchus rufimanus Boh.	5	1	-	-	1	-	7
Apionidae							
Apion sp.	-	-	1	-	1	-	2
Curculionidae							
Tanysphyrus lemnae (Payk.)	-	-	1	-	-	-	1
Ceutorhynchus sp.	-	-	-	-	-	1	1
HYMENOPTERA							
Formicidae	-	-	5	-	-	-	5
Parasitica	-	-	1	-	-	-	1
DIPTERA							
Fam., Gen. et spp. indet. (puparia)	60	-	-	-	52	1	113